

Estimating the sizes of breeding populations of birds in Wales

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Crynodeb

Ers cyhoeddi trafodaethau'r Panel Amcangyfrif Poblogaeth Adar yn 1997 (APEP1) cyhoeddwyd tri amcangyfrif arall o faint poblogaethau adar sy'n nythu ac yn gaeafu ym Mhrydain. Yma, rydym yn defnyddio canlyniadau'r ddau ddiwethaf o'r rhain (APEP3 ac APEP4), ynghyd a data o *Atlas Adar 2007-11* a thueddiadau poblogaeth o'r Arolwg Adar Nythu i amcangyfrif maint poblogaeth 85 rhywogaeth sy'n nythu yng Nghymru.

Summary

Since the publication of the deliberations of the Avian Population Estimates Panel in 1997 (APEP1) there have been three other estimates of the population sizes of breeding and wintering species of bird in Great Britain. Here, we have used the results of the last two of these (APEP3 and APEP4), with data from *Bird Atlas 2007-11* and Breeding Bird Survey population trends to calculate estimates of the population sizes of 85 species that breed in Wales.

Background

During the last 25 years, the quality of information about breeding birds in Wales has improved greatly; in particular, robust trend information is now available for 60 species through the BTO/JNCC/RSPB Breeding Bird Survey (Harris *et al.* 2020). There is, however, limited information on the sizes of breeding bird populations.

Knowing the absolute number of birds is important for those who make decisions about nature conservation, both for policy and delivery on the ground. Such information can be used, for example, in assessments of conservation importance and of extinction risk, and in the implementation of site protection measures. Since 1997, the Avian Population Estimates Panel (APEP) has published a series of reports that quantify the population sizes of both breeding and wintering birds in Great Britain (GB) and in the United Kingdom. The first report was Stone *et al.* (1997), and Woodward *et al.* (2020) compiled the fourth such report, providing revised GB and UK population estimates up to 2016, but there has been no similar exercise for Wales.

Estimates for Wales have been made for the small number of species that have been surveyed under the Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme (SCARABBS), and data have been collected for breeding seabirds through four seabird censuses, most recently the Seabirds Count project (2015-21). The only previous attempt to estimate the populations of other species

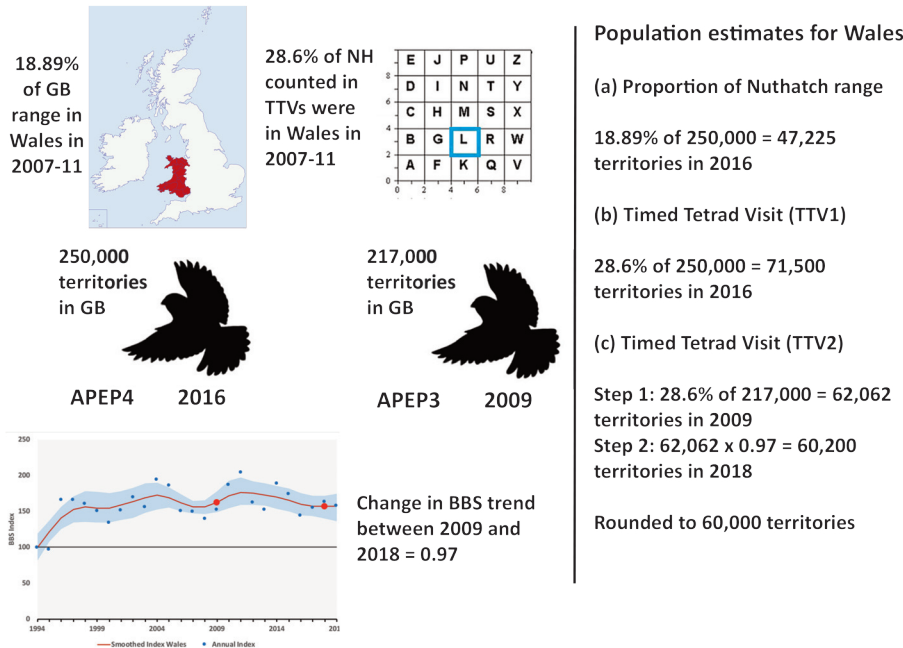
was that made by Green (2002).

The purpose of this paper is to present new estimates for some Welsh breeding bird species. This is part of a project being undertaken by the Welsh Ornithological Society to publish The Birds of Wales (in prep.) in 2021.

Methods

We explored two approaches to generate an estimate for each regular breeding species in Wales. We used spatial data on distribution and abundance patterns from *Bird Atlas 2007-11* (Balmer *et al.* 2013), population trends of breeding birds in Wales from the UK Breeding Bird Survey (Harris *et al.* 2020) and population estimates made for Great Britain by APEP. The methods take different approaches to working out what proportion of the overall GB population estimate can be assigned to Wales and whether to further adjust for recent population changes in Wales. The most straightforward method to estimate the proportion of the GB population occurring in Wales is to determine the proportion of each species' GB range that falls in Wales, using the number of occupied 10-km squares inside and outside Wales from *Bird Atlas 2007-11*. Unfortunately, this calculation is only valid for species that occur at the same density across the whole of Britain, and *Bird Atlas 2007-11* shows that species generally have substantial spatial variation in abundance. This simple method would under-estimate the population size of any species that tends to occur at a higher density in Wales than in other parts of its British range (e.g. Nuthatch, Fig. 1a).

Worked example for Nuthatch



Population estimates for Wales

(a) Proportion of Nuthatch range

18.89% of 250,000 = 47,225
territories in 2016

(b) Timed Tetrad Visit (TTV1)

28.6% of 250,000 = 71,500
territories in 2016

(c) Timed Tetrad Visit (TTV2)

Step 1: 28.6% of 217,000 = 62,062
territories in 2009
Step 2: 62,062 x 0.97 = 60,200
territories in 2018

Rounded to 60,000 territories

Figure 1. A worked example showing the three population estimation methods for Nuthatch (scientific names for species appear in Tables 1, 2 or 3).

A more sophisticated approach is to use spatial variation in abundance to determine the proportion of overall abundance found in Wales. For this we used information from Timed Tetrad Visits (TTV) undertaken during Bird Atlas 2007-11. A Timed Tetrad Visit was when an observer counted all individuals of all species identified, by sight or sound, during one hour, when walking through the habitats within a tetrad. For a selection of tetrads in each 10-km square, these provide a figure for the number of individuals detected per hour; see Chapter 4.4 of Balmer *et al.* (2013) for a more complete description of how these were undertaken. For each species, we calculated the average number of birds detected on TTVs (i.e. birds per hour of survey) for each occupied 10-km square. Summing these across Wales and GB allows an estimate to be made of the proportion of overall abundance in Wales. The 95% confidence limits were calculated for these values by boot strapping (i.e. repeating the process 200 times using randomised subsets of the underlying TTV data in each 10-km square).

We used these figures in one of two ways:

TTV method 1 (Fig. 1b): we multiplied the APEP4 (Woodward *et al.* 2020) population estimate for GB by the proportion of GB abundance in Wales. This method accounts for differences in densities between Wales and the rest of GB during 2007-11. However, the APEP4 estimates for GB are generally for 2016, having used long-term population trends (Common Birds Census and BBS; Massimino *et al.* 2017) to adjust upwards or downwards older population estimates to reflect recent UK-level trends. If population trends differed between Wales and the rest of GB in the intervening period (i.e. 1990 to 2016), our estimates of the proportion of the GB population in Wales may be wrong, leading to errors in our derived Welsh population estimates.

TTV method 2 (Fig. 1c): to overcome this problem we developed a two-step method that used the same TTV data from *Bird Atlas 2007-11* but with population estimates from APEP3 (Musgrove *et al.* 2013). These were derived for 2009, coincident with the atlas fieldwork so do not suffer from the mismatch described above. The first step of this method involved multiplying the 2009 GB population estimate by the proportion of abundance in Wales from the Bird Atlas data, giving a Welsh population estimate for 2009. The second step was to update these figures to 2018 using the population trends for Wales from BBS (Harris *et al.* 2020). Specifically, the ratio of change in the smoothed index value for 2009 and 2018 was multiplied by the 2009 Wales estimate to give a 2018 Wales estimate. This method is only possible for species with a robust population trend in Wales. For this purpose, we used trends for species that occurred in 30 or more BBS squares during that period. The criterion of 30 was adopted as that is the number of squares with data used to generate an annual population index for Wales (e.g. Harris *et al.* 2020).

APEP3 published some estimates without 95% confidence intervals and we have followed that practice. Where APEP3 and APEP4 presented such confidence intervals we multiplied the confidence intervals of the GB estimate by the proportion of abundance in Wales. APEP3 and APEP4 both published estimates based on the numbers of pairs, territories, females or males. We have adopted the same units.

Anomalies

For a small number of species (e.g. Pied Flycatcher), neither APEP3 nor APEP4 made a precise point estimate but showed a range. For these species, the methods above were adjusted slightly, multiplying the lower limit of the GB population estimate with the lower confidence interval value for the proportion of abundance in Wales, and repeating that for the upper value. For these species, the Welsh population estimate is expressed only as a range.

Exclusion filters

The output from each method was produced for each regularly occurring species. We then assessed whether and how to use the outputs through a four-stage filter for each species:

- i. Is there an existing population estimate made using more rigorous survey methods, such as seabird censuses and SCARABBS? This removed 34 species from consideration (see Table 1).
- ii. Does the behaviour of the species mean that the TTV method used in Bird Atlas 2007-11 might provide a poor indication of abundance, especially when scaled down to country level? This removed four nocturnal owl species from consideration (see Table 2).
- iii. Did the species occur in fewer than 50 of the 10-km squares in Wales? This is around 20% of the 10-km squares. In many instances the species occurred in only a small number of tetrads, potentially just one, within a 10-km square. Examples were Eider, Quail and Garganey. This removed 18 species from consideration (see Table 2).
- iv. Was the distribution very unevenly spread across Wales, usually because of the uneven and irregular availability of suitable nesting habitat, or because it is colonial? This removed Oystercatcher, Grey Heron, Little Egret and Sand Martin from consideration (see Table 2). Had we not already removed colonial seabirds in stage i), those too would have been removed here because TTVs perform poorly for strongly aggregated species, especially those around the coast and on islands.

Data accuracy

The TTV methods should lead to the most accurate estimates achievable without undertaking a species-specific census or bespoke analyses of density data, however they are subject to several possible errors.

- i. Musgrove *et al.* (2013) and Woodward *et al.* (2020) assessed the reliability of their estimates. These are the best data available as GB baselines and we have shown their reliability scores in Table 3.
- ii. The proportion of a species' relative abundance that was applied to Wales based on Bird Atlas 2007-11 may have been incorrect. This could arise, for example, if the sample of tetrads in each 10-km square surveyed for TTVs was biased towards the habitat of a species in Wales or biased against its habitat outside Wales. It could also occur if observers in Wales were better at counting birds than observers in the rest of Great Britain. There is no reason to suspect that either of these biases occurred in the Atlas.
- iii. For method TTV2 we are confident of the accuracy of the published BBS trends for Wales (e.g. Harris *et al.* 2020) for species that occur on a minimum of 30 1-km squares. For species that are recorded in fewer than 30 squares, we chose to present results using method TTV1. The method selected for each species is shown in Table 3.

Results and discussion

The population estimates are based on assessment of 85 species (Table 3). The estimates are rounded to two-and-a-half significant figures to conform to the same practice as Woodward *et al.* (2020).¹

The most abundant species in Wales in 2018 was Wren, with 1.3 million territories. Three others had populations in excess of 500,000: Robin (905,000 pairs), House Sparrow (800,000 pairs) and Blackbird (665,000 pairs). Willow Warbler and Blackcap (each 265,000 territories) were the only migratory species to occur in the list of the 10 most populous species (See Table 3). Manx Shearwater *Puffinus puffinus* is alone among the species not presented here that is among the top 10.

Producing a population estimate for Wales that can be compared to that for the whole of Britain allows an assessment of the species for which Wales is particularly important as a breeding species. As context, Wales accounts for approximately 8.5% of the landmass of Britain. From this selection of 85 species, Wales holds more than 25% of the British population of six species: Pied Flycatcher (69-76%), Goshawk (50%), Wood Warbler (44%), Redstart (37%), Red Kite (30%) and Garden Warbler (28%). Other species not assessed in these estimates (e.g. Chough *Pyrrhocorax pyrrhocorax*, Manx Shearwater) also occur in numbers above this threshold.

The estimates presented here have been produced by a different method to those in Green (2002). The limited method details provided there, implied that those drew on the British breeding population estimates made in the *New Atlas of Breeding Birds in Britain and Ireland: 1988-1991* (Gibbons *et al.* 1993), factored for the proportion of the species' range in Wales and updated using the population change information from the Breeding Bird Survey during 1994-99. That is an approach that we explored but disregarded as likely to be less accurate than using the proportion of abundance. It is, thus, important that comparisons are not made (e.g. apparent population changes) between the earlier estimates and those made in this paper.

Conclusions

These estimates are a potential contribution to any future attempt to produce population estimates for all species in Wales, which could also be extended to the non-breeding season. Whether such an effort is worthwhile will depend on the likely use of the data in conservation decision-making, although population figures are in themselves of interest to the birdwatching community. They are also repeatable, if the GB estimates are updated by APEP or using new Atlas data. For that reason, the spreadsheet with the calculations is archived at <https://birds.in.wales/population-estimates-for-wales-2020/>

Our analysis excluded 34 species (filter i) that we considered to be covered by other surveys (Table 1), although a lack of funding means that most species covered by SCARABBS have no forward plan to ensure these are repeated. The 26 species excluded under filters (ii), (iii) and (iv) also merit improved methods to estimate their populations, especially as many are species of conservation concern or their localised occurrence increases the risk of loss from all, or part of, Wales.

The forthcoming publication of *The Birds of Wales* will use expert opinion and local surveys to guesstimate the populations of a number of these, and several others are monitored by the Rare

¹ With two-and-a-half significant figures, the following examples show the rounding; 22,712 becomes 22,500; 758,674 becomes 760,000 and 1,106,220 becomes 1,100,000.

Breeding Birds Panel (RBBP), although there can be high variation in counts between years according to the level of effort by observers. There are several species for which more dedicated survey would produce meaningful population estimates. Priorities for these in Wales were described by Thorpe and Brenchley (2017).

Planning for the next breeding Atlas will get underway in the next few years, and we hope that birdwatchers in Wales will play an active role in data collection for that project. In the meantime, we would urge birdwatchers to engage in regular BBS fieldwork to improve our knowledge of the population trends in Wales for as many species as possible. We would hope that new population estimates could result from these efforts, and that population estimates could, in future, be presented for the constituent nations of Britain.

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References

- Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J. 2013. *Bird Atlas 2007-11; the breeding and wintering birds of Britain and Ireland*. Thetford, BTO Books.
- Conway, G., Wotton, S., Henderson, I., Langston, R., Drewitt, A. and Currie, F. 2007. Status and distribution of European Nightjars *Caprimulgus europaeus* in the UK in 2004. *Bird Study* 54(1): pp.98-111.
- Ewing, S.R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. and Eaton, M.A., 2011. Breeding status of Merlins *Falco columbarius* in the UK in 2008. *Bird Study* 58(4): pp.379-389.
- Gibbons, D.W., Reid, J.B. and Chapman, R.A. 1993. *The new atlas of breeding birds in Britain and Ireland: 1988-1991*. London, T.&A.D. Poyser.
- Green, J. 2002. Birds in Wales 1992-2000. Welsh Ornithological Society.
- Harris, S.J., Massimino, D., Balmer, D.E., Eaton, M.A., Noble, D.G., Pearce-Higgins, J.W., Woodcock, P. and Gillings, S. 2020. *The Breeding Bird Survey 2019*. BTO Research Report 726. Thetford, British Trust for Ornithology.
- Hayhow, D.B., Johnstone, I., Moore, A.S., Mucklow, C., Stratford, A., Šúr, M. and Eaton, M.A., 2018. Breeding status of Red-billed Choughs *Pyrrhocorax pyrrhocorax* in the UK and Isle of Man in 2014. *Bird Study* 65(4): pp.458-470.
- Henderson, I., Noble, D., and Jones, K. 2017. Population estimates and habitat associations for Stonechat (*Saxicola rubicola*), Whinchat (*Saxicola rubetra*) and Wheatear (*Oenanthe oenanthe*) in Wales, 2012 and 2013. *Birds in Wales* 14(1): pp.10-19.
- Johnstone, I.G., Dyda, J. and Lindley, P. 2008. The population status of breeding Golden Plovers and Dunlin in Wales in 2007. *Welsh Birds* 5(4): pp.300-310.
- Massimino, D., Woodward, I.D., Hammond, M.J., Harris, S.J., Leech, D.I., Noble, D.G., Walker, R.H., Barimore, C., Dadam, D., Eglington, S.M., Marchant, J.H., Sullivan, M.J.P., Baillie, S.R. and Robinson, R.A. 2017. *Birdtrends 2017: Trends in numbers, breeding success and survival for UK*

- breeding birds*. Thetford: British Trust for Ornithology.
- Mitchell, P.I. 2004. *Seabird populations of Britain and Ireland*. London: T&AD Poyser.
- Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, D. 2013. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 106(2): pp.64-100.
- Pritchard, R., Hughes, J., Spence, I.M., Haycock, B. and Brenchley, A. (in prep.). *The Birds of Wales*. Liverpool: Liverpool University Press.
- Sim, I.M.W, Eaton, M.A., Setchfield, R.P., Warren, P.K. and Lindley, P. 2008. Abundance of male Black Grouse *Tetrao tetrix* in Britain in 2005, and change since 1995-96. *Bird Study* 55(3): pp.304-313.
- Sim, I.M., Burfield, I.J., Grant, M.C., Pearce-Higgins, J.W. and Brooke, M.D.L., 2007. The role of habitat composition in determining breeding site occupancy in a declining Ring Ouzel *Turdus torquatus* population. *Ibis* 149(2): pp.374-385.
- Stone, B.H., Sears, J., Cranswick, P.A., Gregory, R.D., Gibbons, D.W., Rehfisch, M.M., Aebischer, N.J. and Reid, J. 1997. Population estimates of birds in Britain and the United Kingdom. *British Birds* 90(1): pp.1-22.
- Taylor, R., Bowgen, K., Burton, N. and Franks, S. 2020. *Understanding Welsh breeding Curlew: from local landscape movements through to population estimations and predictions*. NRW Evidence Report (in prep.).
- Thorpe, R.I. and Brenchley, A. 2017. Bird Surveys and Monitoring in Wales: current and required. *Birds in Wales* 14(1): pp.49-62.
- Wilkinson, N.I., Eaton, M.A., Colhoun, K. and Drewitt, A.L., 2018. The population status of breeding Twite *Linaria flavirostris* in the UK in 2013. *Bird Study* 65(2): pp.174-188.
- Williams, G. 2018. The breeding population of Peregrine (*Falco peregrinus*) in Wales in 2014. *Birds in Wales* 15(1): pp.3-8.
- Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D. and Noble, D. 2020. Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113(2): pp.69-104.
- Wotton, S.R., Bladwell, S., Mattingley, W., Morris, N.G., Raw, D., Ruddock, M., Stevenson, A. and Eaton, M.A., 2018. Status of the Hen Harrier *Circus cyaneus* in the UK and Isle of Man in 2016. *Bird Study* 65(2): pp.145-160.
- Wotton, S. and Conway, G. 2008. The Woodlark and Dartford Warbler surveys in Wales in 2006. *Welsh Birds* 5(4): pp.322-27.
- Wotton, S., Conway, G., Eaton, M., Henderson, I. and Grice, P., 2009. The status of the Dartford Warbler in the UK and the Channel Islands in 2006. *British Birds* 102(5): pp.230-246.

English name	Scientific name	Source of most recent population
Black Grouse	<i>Lyrurus tetrix</i>	Sim <i>et al.</i> 2008
Nightjar	<i>Caprimulgus europaeus</i>	Conway <i>et al.</i> 2007
Lapwing	<i>Vanellus vanellus</i>	Hughes in prep.
Golden Plover	<i>Pluvialis apricaria</i>	Johnstone <i>et al.</i> 2008
Ringed Plover	<i>Charadrius hiaticula</i>	Conway <i>et al.</i> 2008
Little Ringed Plover	<i>Charadrius dubius</i>	Conway <i>et al.</i> 2008
Curlew	<i>Numenius arquata</i>	Taylor <i>et al.</i> 2020
Dunlin	<i>Calidris alpina</i>	Johnstone <i>et al.</i> 2008
Kittiwake	<i>Rissa tridactyla</i>	Mitchell <i>et al.</i> 2004
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	Mitchell <i>et al.</i> 2004
Mediterranean Gull	<i>Ichthyaeetus melanocephalus</i>	Mitchell <i>et al.</i> 2004
Great Black-backed Gull	<i>Larus marinus</i>	Mitchell <i>et al.</i> 2004
Herring Gull	<i>Larus argentatus</i>	Mitchell <i>et al.</i> 2004
Lesser Black-backed Gull	<i>Larus fuscus</i>	Mitchell <i>et al.</i> 2004
Common Tern	<i>Sterna hirundo</i>	Mitchell <i>et al.</i> 2004
Common Guillemot	<i>Uria aalge</i>	Mitchell <i>et al.</i> 2004
Razorbill	<i>Alca torda</i>	Mitchell <i>et al.</i> 2004
Black Guillemot	<i>Cephus grylle</i>	Mitchell <i>et al.</i> 2004
Puffin	<i>Fratercula arctica</i>	Mitchell <i>et al.</i> 2004
Fulmar	<i>Fulmarus glacialis</i>	Mitchell <i>et al.</i> 2004
Shag	<i>Phalacrocorax aristotelis</i>	Mitchell <i>et al.</i> 2004
Cormorant	<i>Phalacrocorax carbo</i>	Mitchell <i>et al.</i> 2004
Osprey	<i>Pandion haliaetus</i>	Welsh Bird Report 2018
Hen Harrier	<i>Circus cyaneus</i>	Wotton <i>et al.</i> 2018
Merlin	<i>Falco columbarius</i>	Ewing <i>et al.</i> 2007
Peregrine	<i>Falco peregrinus</i>	Williams 2018
Chough	<i>Pyrrhocorax pyrrhocorax</i>	Hayhow <i>et al.</i> 2014
Willow Tit	<i>Poecile montanus</i>	Wotton, in prep.
Dartford Warbler	<i>Sylvia undata</i>	Wotton and Conway 2008
Ring Ouzel	<i>Turdus torquatus</i>	Wotton <i>et al.</i> 2016
Whinchat	<i>Saxicola rubetra</i>	Henderson <i>et al.</i> 2017
Stonechat	<i>Saxicola rubicola</i>	Henderson <i>et al.</i> 2017
Wheatear	<i>Oenanthe oenanthe</i>	Henderson <i>et al.</i> 2017
Twite	<i>Linaria flavirostris</i>	Wilkinson <i>et al.</i> 2018

Table 1. Species (34) for which other methods have estimated population size in Wales.

English name	Scientific name	10km sq occupied in Wales 2007-11	Reason for exclusion
Grey Partridge	<i>Perdix perdix</i>	32	Fewer than 50 occupied 10-km squares in Wales; may include some released birds
Quail	<i>Coturnix coturnix</i>	48	Fewer than 50 occupied 10-km squares in Wales
Mandarin Duck	<i>Aix galericulata</i>	26	Fewer than 50 occupied 10-km squares in Wales
Garganey	<i>Spatula querquedula</i>	8	Fewer than 50 occupied 10-km squares in Wales
Shoveler	<i>Spatula clypeata</i>	23	Fewer than 50 occupied 10-km squares in Wales
Gadwall	<i>Mareca strepera</i>	33	Fewer than 50 occupied 10-km squares in Wales
Pochard	<i>Aythya ferina</i>	20	Fewer than 50 occupied 10-km squares in Wales
Eider	<i>Somateria mollissima</i>	7	Fewer than 50 occupied 10-km squares in Wales
Red-breasted Merganser	<i>Mergus serrator</i>	37	Fewer than 50 occupied 10-km squares in Wales
Turtle Dove	<i>Streptopelia turtur</i>	4	Fewer than 50 occupied 10-km squares in Wales
Oystercatcher	<i>Haematopus ostralegus</i>	106	Uneven distribution
Woodcock	<i>Scolopax rusticola</i>	28	Fewer than 50 occupied 10-km squares in Wales
Redshank	<i>Tringa totanus</i>	27	Fewer than 50 occupied 10-km squares in Wales
Grey Heron	<i>Ardea cinerea</i>	170	Colonial
Little Egret	<i>Egretta garzetta</i>	27	Colonial
Honey-buzzard	<i>Pernis apivorus</i>	-	Fewer than 50 occupied 10-km squares in Wales
Barn Owl	<i>Tyto alba</i>	156	Nocturnal
Tawny Owl	<i>Strix aluco</i>	228	Nocturnal
Little Owl	<i>Athene noctua</i>	81	Nocturnal
Long-eared Owl	<i>Asio otus</i>	10	Nocturnal
Sand Martin	<i>Riparia riparia</i>	195	Colonial
Cetti's Warbler	<i>Cettia cetti</i>	47	Fewer than 50 occupied 10-km
Firecrest	<i>Regulus ignicapilla</i>	9	Fewer than 50 occupied 10-km
Tree Sparrow	<i>Passer montanus</i>	48	Fewer than 50 occupied 10-km
Yellow Wagtail	<i>Motacilla flava</i>	19	Fewer than 50 occupied 10-km
Hawfinch	<i>Coccothraustes coccothraustes</i>	19	Fewer than 50 occupied 10-km squares in Wales

Table 2. Species (26) for which it was decided that we were unable to estimate their population sizes. The reasons for exclusion are shown.

English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Red Grouse	<i>Lagopus lagopus</i>	1	P	55	835	490	1,450	3
Red-legged Partridge	<i>Alectoris rufa</i>	1	T	77	1,400	940	1,850	2
Pheasant	<i>Phasianus colchicus</i>	1	F	244	165,000	160,000	175,000	2
Canada Goose	<i>Branta canadensis</i>	2	P	219	8,850	-	-	3
Greylag Goose	<i>Anser anser</i>	1	P	111	1,650	965	2,050	3
Mute Swan	<i>Cygnus olor</i>	1	P	140	485	400	585	2
Shelduck	<i>Tadorna tadorna</i>	1	P	88	1,250	725	2,250	3
Mallard	<i>Anas platyrhynchos</i>	2	P	258	-	4,600	11,000	3
Teal	<i>Anas crecca</i>	1	P	70	-	60	250	3
Tufted Duck	<i>Aythya fuligula</i>	1	P	103	-	765	1,350	3
Goosander	<i>Mergus merganser</i>	1	P	121	685	565	855	2
Swift	<i>Apus apus</i>	2	P	238	4,100	3,000	5,250	3
Cuckoo	<i>Cuculus canorus</i>	2	P	218	1,900	1,000	2,750	3
Rock Dove	<i>Columba livia</i>	2	P	178	41,000	33,500	49,000	2
Stock Dove	<i>Columba oenas</i>	2	T	192	21,500	-	-	2
Woodpigeon	<i>Columba palumbus</i>	2	P	259	295,000	280,000	315,000	2
Collared Dove	<i>Streptopelia decaocto</i>	2	P	247	87,000	78,000	95,500	2
Water Rail	<i>Rallus aquaticus</i>	1	T	56	215	110	315	2
Moorhen	<i>Gallinula chloropus</i>	1	T	203	14,500	13,500	15,500	2
Coot	<i>Fulica atra</i>	1	P	139	1,600	1,250	2,050	3
Little Grebe	<i>Tachybaptus ruficollis</i>	1	P	148	-	240	640	2
Great Crested Grebe	<i>Podiceps cristatus</i>	1	P	84	270	210	370	2
Snipe	<i>Gallinago gallinago</i>	1	P	103	1,100	820	1,400	3
Common Sandpiper	<i>Actitis hypoleucos</i>	1	P	114	490	395	565	2
Sparrowhawk	<i>Accipiter nisus</i>	1	P	245	2,950	2,700	3,200	2
Goshawk	<i>Accipiter gentilis</i>	1	P	120	310	260	350	2
Red Kite	<i>Milvus milvus</i>	2	P	175	1,350	-	-	2
Buzzard	<i>Buteo buteo</i>	2	P	255	-	9,850	13,500	2
Kingfisher	<i>Alcedo atthis</i>	1	P	138	-	445	970	3
Lesser Spotted Woodpecker	<i>Dryobates minor</i>	1	P	70	-	105	320	3
Great Spotted Woodpecker	<i>Dendrocopos major</i>	2	P	247	21,500	19,500	23,500	2
Green Woodpecker	<i>Picus viridis</i>	2	P	162	3,350	3,000	3,750	2
Kestrel	<i>Falco tinnunculus</i>	1	P	214	1,750	1,550	1,900	2
Hobby	<i>Falco subbuteo</i>	1	P	83	205	160	265	2
Jay	<i>Garrulus glandarius</i>	2	T	240	35,500	-	-	2
Magpie	<i>Pica pica</i>	2	T	258	79,500	-	-	2
Jackdaw	<i>Coloeus monedula</i>	2	P	256	155,000	135,000	175,000	2
Rook	<i>Corvus frugilegus</i>	2	P	236	35,500	28,500	37,500	2

English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Carriion Crow	<i>Corvus corone</i>	2	T	261	160,000	-	-	2
Raven	<i>Corvus corax</i>	2	P	258	2,150	-	-	3
Coal Tit	<i>Pariparus ater</i>	2	T	247	75,000	-	-	2
Marsh Tit	<i>Poecile palustris</i>	1	T	152	4,850	4,400	5,300	2
Blue Tit	<i>Cyanistes caeruleus</i>	2	T	258	415,000	-	-	2
Great Tit	<i>Parus major</i>	2	T	257	255,000	-	-	2
Skylark	<i>Alauda arvensis</i>	2	T	258	115,000	-	-	2
Swallow	<i>Hirundo rustica</i>	2	T	258	82,000	-	-	2
House Martin	<i>Delichon urbicum</i>	2	P	258	67,500	47,500	87,500	2
Long-tailed Tit	<i>Aegithalos caudatus</i>	2	T	244	28,000	-	-	2
Wood Warbler	<i>Phylloscopus sibilatrix</i>	1	M	161	2,850	2,650	3,100	3
Willow Warbler	<i>Phylloscopus trochilus</i>	2	T	255	265,000	-	-	2
Chiffchaff	<i>Phylloscopus collybita</i>	2	T	258	245,000	-	-	2
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	1	T	207	19,500	17,500	21,500	2
Reed Warbler	<i>Acrocephalus scirpaceus</i>	1	P	108	11,000	8,700	13,500	2
Grasshopper Warbler	<i>Locustella naevia</i>	1	T	203	2,000	1,800	2,200	3
Blackcap	<i>Sylvia atricapilla</i>	2	T	253	265,000	-	-	2
Garden Warbler	<i>Sylvia borin</i>	2	T	241	39,500	-	-	2
Lesser Whitethroat	<i>Sylvia curruca</i>	1	T	152	6,950	6,150	7,800	2
Whitethroat	<i>Sylvia communis</i>	2	T	255	79,500	-	-	2
Goldcrest	<i>Regulus regulus</i>	2	T	250	85,500	-	-	2
Wren	<i>Troglodytes</i>	2	T	260	1,300,000	-	-	2
Nuthatch	<i>Sitta europaea</i>	2	T	238	60,000	-	-	2
Treecreeper	<i>Certhia familiaris</i>	2	T	232	37,500	-	-	2
Starling	<i>Sturnus vulgaris</i>	2	P	225	90,000	79,000	100,000	2
Blackbird	<i>Turdus merula</i>	2	P	260	665,000	635,000	695,000	2
Song Thrush	<i>Turdus philomelos</i>	2	T	254	160,000	-	-	2
Mistle Thrush	<i>Turdus viscivorus</i>	2	T	248	26,000	-	-	2
Spotted Flycatcher	<i>Muscicapa striata</i>	1	T	225	5,700	5,300	6,050	3
Robin	<i>Erithacus rubecula</i>	2	T	260	905,000	-	-	2
Pied Flycatcher	<i>Ficedula hypoleuca</i>	1	P	171	-	15,000	19,000	3
Redstart	<i>Phoenicurus phoenicurus</i>	2	P	192	50,500	36,500	65,000	2
Dipper	<i>Cinclus cinclus</i>	1	P	200	-	1,150	4,050	2
House Sparrow	<i>Passer domesticus</i>	2	P	258	800,000	725,000	870,000	2
Dunnock	<i>Prunella modularis</i>	2	T	261	310,000	-	-	2
Grey Wagtail	<i>Motacilla cinerea</i>	2	P	227	5,950	-	-	3
Pied Wagtail	<i>Motacilla alba</i>	2	P	259	56,000	49,000	63,500	2

English name	Scientific name	TTV method	units	10km sq occupied in Wales	Wales population estimate	Estimate (lower CI)	Estimate (upper CI)	Rel.
Meadow Pipit	<i>Anthus pratensis</i>	2	P	251	170,000	150,000	195,000	2
Tree Pipit	<i>Anthus trivialis</i>	2	P	175	16,500	10,500	22,500	2
Chaffinch	<i>Fringilla coelebs</i>	2	T	258	470,000	-	-	2
Bullfinch	<i>Pyrrhula pyrrhula</i>	2	T	246	29,500	-	-	2
Greenfinch	<i>Chloris chloris</i>	2	P	255	38,000	35,500	40,500	2
Linnet	<i>Linaria cannabina</i>	2	T	258	47,500	-	-	2
Goldfinch	<i>Carduelis carduelis</i>	2	P	260	180,000	160,000	195,000	2
Siskin	<i>Spinus spinus</i>	2	P	219	58,500	-	-	3
Yellowhammer	<i>Emberiza citrinella</i>	1	T	168	31,500	29,000	33,500	2
Reed Bunting	<i>Emberiza schoeniclus</i>	2	T	231	17,500	-	-	2

Table 3. Population estimates for 85 species that breed in Wales. The method used is shown as TTV1 (2016) or TTV2 (2018). Units: P (pairs), F (females), M (males) or T (territories). Rel. is the reliability score for each species - 1 (good) to 3 (poor) - from Musgrove *et al.* (2013) or Woodward *et al.* (2020) as appropriate. The nine most abundant species, apart from Manx Shearwater, are named in bold.

Long-term aggression towards humans in a Buzzard (*Buteo buteo*)

There have been a number of reports of Buzzard exhibiting aggressive behaviour towards humans in Wales, for example Driver (2004) and Moore (2005). The following is an example of attacks of this kind, presumably by the same bird, over a period of at least six years.

Attacks on humans by the male bird of a pair of Buzzards breeding near Pentir, Caernarfonshire, have been recorded during the breeding season every year between 2014 and 2019. The nest is close to a minor road, and I have had reports of several passers-by each year being attacked by the bird. Many of the attacks involve persistent stoops at the head, without making physical contact, but a number of people have been struck around the head hard enough to draw blood. At least one person suffered extensive lacerations of the scalp causing considerable bleeding.

People attacked by the bird appear to be exclusively pedestrians; I have not heard of any attacks on cyclists or horse riders, who also regularly pass the nest area. The majority of those attacked appear to be joggers rather than walkers. A number of local joggers have changed their regular routes to avoid the bird.

Rhion Pritchard

References

- Driver, J. 2004. Exceptionally aggressive Buzzards in North Wales. *Welsh Birds* 4(1): pp.60-64.
 Moore, J. 2005. Aggressive Buzzard in Ceredigion. *Welsh Birds* 4(3): p.268.



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